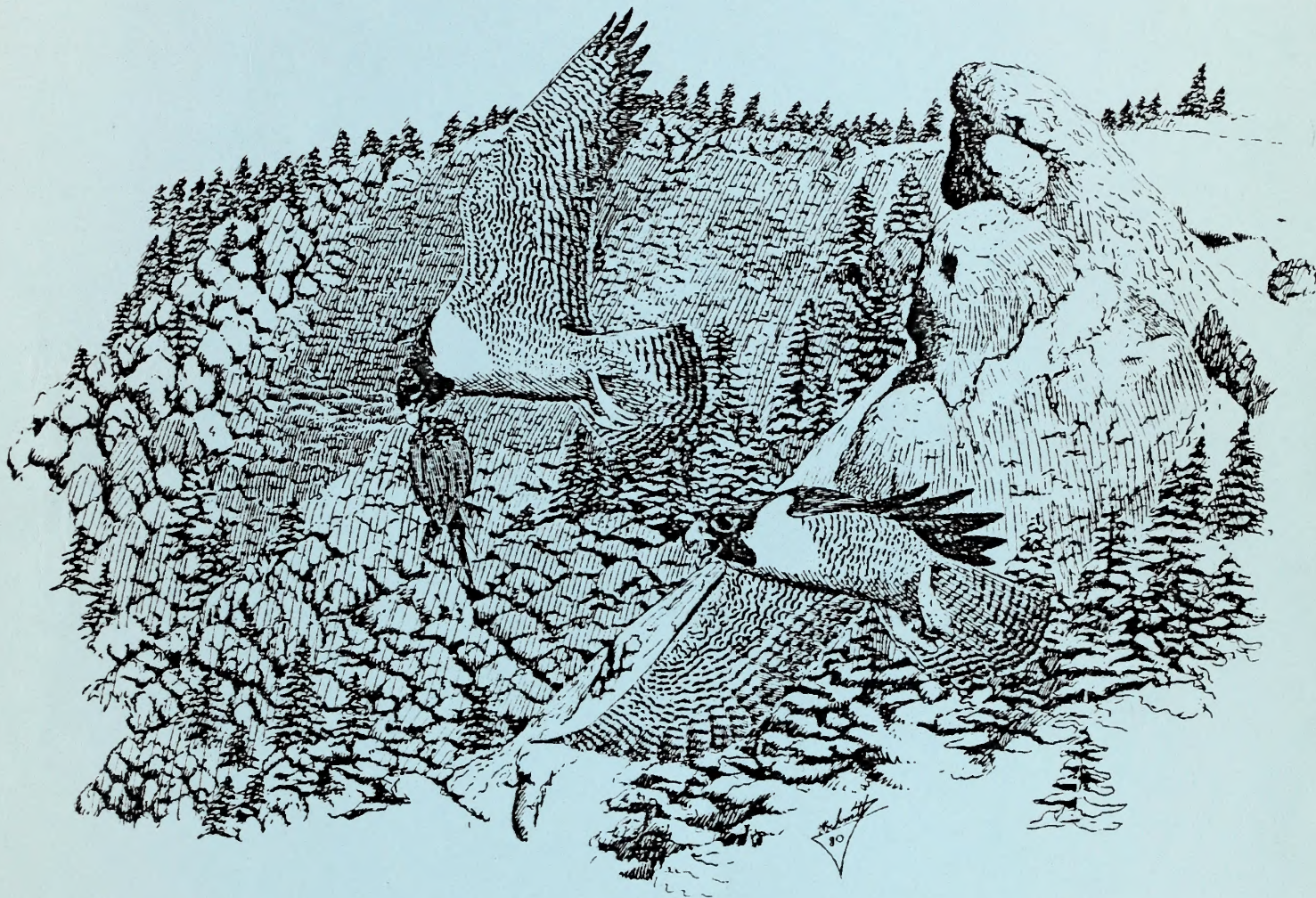




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PEREGRINE FALCON INVENTORY

DATA EVALUATION AND MANAGEMENT RECOMMENDATIONS



By: GEOFF MONK

DECEMBER 1980



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Ukiah District Office



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Ukiah District Office
U.S. Bureau of Land Management

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INTRODUCTION

Precipitous population declines of American peregrine falcons (*Falco peregrinus anatum*) in North America have been documented most notably by Hickey (1969) and specifically in California by Herman et al. (1970) and Herman (1971). These sharp declines in the American peregrine falcon population and parallel declines in worldwide peregrine falcon populations led to this species listing as an endangered species by the U.S. Department of the Interior. The Bureau of Land Management (BLM) has been placed under Presidential directive to implement endangered species inventories and to develop management programs for endangered species.

For the past two years, the Ukiah District of the BLM has been involved in an intensive peregrine falcon management program. In 1979, surveys within the realm of the Ukiah District uncovered a nesting population that represents one of the densest known populations in the continental United States (Monk 1979, Boyce 1979). The 1979 effort emphasized location of nesting sites. This year's program and effort proceeded with further nesting surveys and also branched into active management of the peregrine falcon population. This project was a cooperative management program coordinated with and supported by the U.S. Fish and Wildlife Service, U.S. Forest Service, California Department of Fish and Game, National Audubon Society, and the University of California, Santa Cruz Predatory Bird Research Group (SCPBRG).

Objectives of the Ukiah BLM program were to survey all BLM habitats that were not inventoried last year and, further, to survey habitats within a potential impact distance from BLM parcels. In addition, funds from the other Federal agencies cooperating in this program made helicopter time available for surveying prime habitats on U.S. Forest Service lands and on private properties. Other objectives of this program were to assist the SCPBRG efforts to actively manage (manipulate) peregrine falcon eyries (nests) with a history of egg breakage, to band young, and to gather prey utilization data.

THE STUDY AREA AND PERTINENT DISCUSSIONS

The Ukiah District encompasses approximately 455,944 acres of public domain between latitudes running through Santa Rosa and Crescent City. These lands occur in many scattered parcels, from the immediate coastline to the Central Valley, including the major coastal mountain system known as the Coast Range.

Kuchler (1964) classified the coastline of Northern California as falling within the "Redwood Forest (*Sequoia-Pseudotsuga*)" vegetative ecotone. Traveling eastward, the vegetation changes into a complex of "Mixed Hardwood Forest with Rhododendron (*Arbutus-Lithocarpus-Pseudotsuga-Quercus-Rhododendron*)," Chaparral (*Adenostomata-Arcostaphylos-Ceanothus*)," "Blue Oak-Digger Pine Forest (*Pinus-Quercus*)," and "Coast Range Montane Forest and Evergreen Forest with Chinquapin (*Arbutus-Lithocarpus-Pseudotsuga-Quercus-Rhododendron*)." These dominating plant communities contain extremely diverse assemblages of subdominates and subordinate plant species. In turn, these plant communities

support an equally diverse assemblage of wildlife species. Kirven (1980) recorded over 77 bird species in a relatively small area within the described coast range plant communities. Kirven considered many of these bird species potential peregrine falcon prey species.

Peregrine falcon nesting sites are found in a variety of vegetative communities; however, the presence of "coastal prairies" (grasslands) is a vegetative feature common to all observed nesting habitats. These grasslands provide ecotonal hunting areas open to aerial pursuits of prey by peregrines. In every case, peregrines nesting within the Ukiah District will be found within two miles (3.2 km) of these grasslands and in many cases are considerably closer. Coastal prairies vary in size, but probably average about 10 to 50 acres.

In addition to the vegetative relationships, the geology of the Ukiah District has apparent relationships to nesting peregrines. Throughout the North Coast, rocky extrusions and exposures can be found. These rocky exposures consist of sedimentary slips, shale cliff exposures, serpentine extrusions, sandstone conglomerates, and graywacke sandstones.

In almost all cases, it is the graywacke sandstone cliffs that are selected by peregrines for nesting. This rock type is relatively smooth and stable and most of the time contains many holes and ledges. Other seemingly suitable cliffs of different geomorphologic structure and composition usually lacked holes and ledges, precluding use by nesting peregrines.

METHODS AND MATERIALS

Survey Technique

During the spring and summer months of 1979, most prominent rocky extrusions in the Ukiah BLM District were mapped from fixed-wing aircraft onto 15 minute USGS topographic maps. These rocky extrusions were rated numerically on a scale of one to ten based on subjective estimates of their value to peregrines. Subsequent rotor-wing surveys in 1979 covered most of the highly rated rocks and left approximately 60 rocky extrusions unsurveyed that were considered mediocre, but acceptable peregrine nesting habitat. (For details, see Monk 1979). During the 1979 surveys, two peregrine eyries were located on rocks subjectively considered as having mediocre value to nesting peregrines. From these examples it became apparent that the rocky extrusions with lower ratings should be surveyed in the future. This year most of these unsurveyed rocky extrusions and others that were newly located were surveyed by rotor-winged aircraft (helicopters).

Survey timing was considered very important for a "best results" effort. Observations at known nesting sites from a ground position showed a remarkable degree of nest phase synchrony between sites (Appendix I). By observing dates of beginning incubation at two sites, a target date was scheduled in advance that put the survey helicopter in the air when most eyries contained nestlings two to three weeks of age. (For further discussion on the importance of survey timing, see "Helicopter Effectiveness.")

A turbo-charged Bell Jet Ranger III was used for surveying cliffs. This helicopter was used because of a high cruising speed, which facilitated covering long distances between habitats to be observed, and because jet helicopters are apparently less disturbing to nesting raptors (White and Sherrod 1973). The actual flight technique involved passing by cliffs to 40 to 50 mph (64 to 80 km/hr), approximately 40 yards out from the face. If raptor activity was observed, the helicopter would return and hover in front of the cliff for up to a minute.

At cliffs where peregrine eyries were located, photos were taken with two 35mm cameras, using 55mm and 300mm lenses. The 55mm lense was used to photograph the entire nesting cliff and will be used in future years for reference. The 300mm lense was used to photograph nesting birds, eggs, and/or nestlings. These photos greatly enhanced gathering productivity data and allowed an accurate judgement of nestling ages. Just how valuable these photos were for gathering productivity data and aging nestlings was not discovered until after the fact. In several cases the number of nestlings was incorrectly counted from the helicopter and the estimated ages of other nestlings were incorrect. Photographs of young facilitated banding efforts, since the project was under strict mandates to band nestlings at four weeks of age. Also, synchronizing ground surveys with the approximate dates young fledged, to verify fledging success, helped ensure that valuable time was not wasted getting into a nesting site where young might not have fledged yet.

Active Management Technique

Peregrine falcon nesting sites with a past history of at least two consecutive nesting failures were selected last year so that behavior of the adult falcons could be monitored prior to egg laying this year. The first day of incubation was judged on several factors, the most prominent being the first time the female falcon was observed spending the night in the eyrie. Two eyries were rappelled into, and eggs were removed within four days of clutch completion. These eggs were immediately placed into a portable incubator unit supplied and manned by personnel from the SCPBRG. This unit was then shuttled immediately to U.C. Santa Cruz via fixed-wing aircraft. Upon arrival at the SCPBRG's breeding project, the eggs were removed from the portable incubator and placed into a Marsh Farms Roll-X incubator. (For greater detail, refer to Walton 1980.) After young were hatched in captivity, they were then hand-reared and/or fostered to captive falcons. At two weeks of age, the young were then transferred from the Santa Cruz project, via automobile, back to the Ukiah BLM District for fostering-out to wild eyries.

Nestling peregrines were banded when young were three to four weeks of age. U.S. Fish and Wildlife Service "lock-on" type bands were used for this effort. At the time young were banded, all prey remains and egg shell fragments were gathered from within the eyries. Also, prey remains were gathered along the tops and bases of nesting cliffs, especially below snags previously noted as being preferential feeding and depluming locations. Most prey remains were identified by comparing individual feathers and bones gathered at the eyries with whole bird mounts contained within the Sonoma State University and U.C. Berkeley vertebrate collections.

RESULTS

During the 1979 peregrine falcon survey in the Ukiah BLM District, 455,944 acres of public domain were surveyed by fixed-wing aircraft. A total of 205 rocky outcroppings were identified and mapped. Cliffs were then surveyed by helicopter in search of nesting peregrines. This year (1980) approximately 85 cliffs were surveyed by helicopter and, of these, 60 (70 percent) were mapped in 1979 but not surveyed by helicopter. A total of 20 active peregrine falcon eyries were observed from the survey helicopter, and an additional three eyries were observed from the ground during the 1980 nesting season. Twenty-two nesting sites are within the realm of the Ukiah BLM District, and a single eyrie is in the Redding BLM District. Productivity statistics that follow in this report consider only the 22 eyries within the boundary of the Ukiah District. However, "Helicopter Effectiveness" statistics also consider productivity at the Redding District nesting site.

Six of the 21 eyries observed from the helicopter were newly located this year. Only four of these six previously unknown eyries had a visible nest ledge, but all six sites were observed with defending falcons. (For further discussion, see "Helicopter Effectiveness.") In addition, four previously unknown prairie falcon (*Falco mexicanus*) eyries were located this year.

Peregrine falcon eyries located this year followed similar trends observed last year, in that the size of nesting cliffs are much smaller than

most known nesting cliffs in California. Nesting cliffs in northwestern California vary in height and width from approximately 85 feet (26.2 m) by 60 feet (18.5 m), respectively, to over 300 feet (92.3 m) by two miles (3.2 km), respectively. Nest cavities varied in dimension (height, width, depth) from 2.6 feet (0.8 m) x 3.3 feet (1 m) x 5.9 feet (1.5 m) (NI 15) to 6.6 feet (2 m) x 9.8 feet (3 m) x 8.2 feet (2.5 m) (NI 6).

Productivity

Productivity was determined using two different methods. The most direct method involved visiting nesting sites on the ground ("ground-truthing") and counting the number of young that successfully fledged. This was accomplished by several observers at 18 of the 22 active eyries surveyed. The second method used to produce productivity statistics involved counting young in the eyrie from a survey helicopter. These data were then compared to data gathered on the ground at the same nesting sites after nestlings had fledged. By cross-referencing these productivity data, an estimated mortality figure for nestlings was derived. By extrapolation, an additional two eyries that could not be ground-truthed were included in the productivity statistics.

A total of 24 young were observed fledging from 18 nesting attempts with a known outcome (nest sites NI 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15*, 16, 17, 19, 20, 22), or 1.33 nestlings fledged per nest attempt (uncorrected fledging success). The uncorrected fledging success at eyries fledging young (successful eyries only) was 2.18 young fledged per eyrie (n=11). Of 22 peregrine falcon eyries observed in northwestern California, at least 32 percent (n=7) failed to fledge young. Five eyries failed during the egg phase of the

*This site was augmented from 0 to 1 nestling, but is counted as fledging zero.

nesting cycle (NI 1, 3, 5, 13, 15). At the remaining two sites that failed (NI 4, 20), eggs were never laid; however, pairs of adult falcons were observed occupying these nest sites.

Productivity at two of the 22 sites (NI 18, 21) could not be verified from the survey helicopter, and neither site was ground-truthed. Productivity was verified from the helicopter at two additional nest sites (NI 7, 11); however, like sites NI 18 and 21, neither of these sites could be ground-truthed. So, in addition to the 18 nesting sites with a known outcome, nest sites NI 7 and 11 had a predictable outcome. At these two sites, three nestlings were counted from the helicopter when they were approximately three weeks of age. At an additional eight nesting sites, where young could be accurately (accurately implies no holes, cracks, or vegetation for nestlings to hide in) counted and photographed from the helicopter, 14 of 16 nestlings observed in the eyrie were later observed successfully fledging. This suggests a 13 percent mortality rate between the mid-nesting stages of the nest cycle and two weeks after fledging. By extrapolation it can be assumed that 2.61 (all three) of the three nestlings in the two eyries that were not ground-truthed survived fledging. Therefore, the correct fledging success for 20 eyries with a predictable outcome was 1.35 young fledged per nest attempt and 2.08 young fledged per nest fledging young (n=13). It is important to determine a reasonable estimate of fledging success for sites that cannot be ground-truthed. Many peregrine falcon eyries are too remote (even in California) to ground-truth after an initial helicopter survey.

Manipulation Program

In addition to identifying critical nesting habitat and monitoring the productivity of peregrine falcons, the efforts of the Ukiah District of the

BLM pursued an active management program in coordination with the Santa Cruz Predatory Bird Research Group. In all, three peregrine falcon eyries were manipulated. Two of these sites had two-year past histories of failing to fledge young and were scheduled for recycling (removing the first clutch of eggs to induce a second clutch) this year (NI 3, 13). Approximately two to three days after the female falcons began to incubate, their eggs were removed and placed into an artificial incubator. One pair of falcons recycled and laid a second clutch of eggs as expected (NI 3). The other pair of falcons failed to recycle, although they remained in the proximity of the nesting cliff for at least three weeks (NI 13).

According to other research projects, failure to recycle is an unusual circumstance that only occurs 10 to 15 percent of the time (Armbruster 1978, Fyfe and Armbruster 1977). Failure to recycle can be caused by at least two factors: (1) the female falcon is two years of age or younger (first clutch ever laid) and (2) since falcons usually do not lay their second clutch in the same scrape, there must be a suitable alternate nest ledge available to recycle into (Fyfe, personal communication). In captive breeding facilities managed by the Canadian Wildlife Service (CWS), peregrine falcons that have had their first clutch of eggs removed to induce recycling and that did not have an alternate nest ledge were observed dropping eggs to the ground. It is probable that the failure of the female falcon to recycle at site NI 13 was a response to the characteristics of the nesting cliff and interspecific competition with great horned owls (*Bubo virginianus*). This cliff has few suitable ledges and holes, as indicated by the substandard nest cavity used by the peregrines. The only high quality (subjective estimate) nest ledge on this cliff was approximately 40 yards (36.1 m) from the selected peregrine

eyrie and was occupied by earlier nesting great horned owls. It was not known that these owls were present when the peregrine's eggs were removed. To make the situation worse, there were no other suitable nesting cliffs for a minimum distance of three miles (4.8 km).

The second pair of peregrine falcons that had their first clutch of eggs removed (NI 3) laid a second clutch of eggs; however, the eggs remained under the incubating falcons too long due to helicopter scheduling problems and were lost. These eggs were incubated at least 18 days without mishap but, by day 23, all eggs were missing and assumed broken and/or eaten.

The third peregrine falcon eyrie to be manipulated (NI 15) was not a scheduled manipulation as were the other two eyries. During a helicopter survey, this eyrie was observed with three eggs in the scrape during a period when most successful pairs of peregrines had three-week-old nestlings. It was surmised that this pair of falcons lost their first clutch of eggs and recycled on their own. A visit to the eyrie six days later confirmed problems, as only one egg remained. This egg was immediately taken and placed into an artificial incubator. Simultaneously, a 14-day-old peregrine chick, hatched in captivity, was placed into the eyrie. This nestling successfully fledged three weeks later. The egg that was removed hatched, although it was notably dehydrated. The dehydration was probably a result of pesticide-induced egg-shell thinning, allowing too much moisture to escape the egg while it was being incubated. In all likelihood, the chick would not have survived if left in the nest (Walton, personal communication).

The active management program practiced within the Ukiah BLM District achieved fair success. Five chicks hatched from seven eggs removed from

wild peregrines. In all probability, these eggs would not have survived hatching in the wild. Four chicks were fostered-out to other peregrine falcons that failed to hatch their own eggs elsewhere in the State, and the fifth chick was retained for captive breeding.

PESTICIDES AND EGGSHELL THINNING

Field and laboratory experiments have shown that DDE (a metabolite of DDT) physiologically induces eggshell thinning (Wiemeyer and Porter 1970, Cade et al. 1971, Lincer 1972) and is believed responsible for the nesting failures observed in this study. Peakall et al. (1975) demonstrated that 15 to 20 parts per million (ppm) wet weight analysis is the critical level of DDE contamination associated with nesting failure. Analysis of ten peregrine falcon eggs collected by the Santa Cruz Predatory Research Group and associates this year revealed that DDE is still being accumulated by peregrines at greater than critical levels. The mean DDE burden within these ten eggs, collected at sites with previous histories of poor productivity, was 24 ppm $\pm$ 9 ppm (Monk et al. 1980).

In addition, eggshell fragments were collected from five eyries for thickness measurements (Table 1). Pre-DDT eggshell measurements, as determined from museum collections, average 0.369 mm; the average eggshell thickness observed during this study was 0.332 mm. The eggshell thickness measurement associated with nesting failure is approximately 0.314 mm, or 15 percent thinning (Kiff and Peakall 1980).

TABLE 1.

EGGSHELL THICKNESSES AT FIVE EYRIES *

<u>Site No.</u>	<u>Nesting Success</u>	<u>Thickness (mm)</u>
NI 3 /1	Failed	0.311
NI 10	Successful	0.340
NI 13 /1,2	Failed	0.313
NI 16	Successful	0.330
NI 17	Successful	0.365

* (Kiff et al. 1980)

1. Manipulated sites.
2. Mean Thickness for three eggs.

Kiff (personal communication) has found that peregrine falcon eggshells collected over the entire State are showing a trend of increasing thickness, and he views this as encouraging. Nevertheless, there are still individual pairs of peregrines laying critically thin eggs. Manipulated sites NI 3 and NI 13 were found containing eggshell thicknesses averaging 0.313 mm. In addition, the DDE level measured in eggs from site NI 13 averaged 25 ppm wet weight, well above the level associated with nesting failure. Egg contents from site NI 3 were not available for pesticide analysis; however, a mean eggshell thickness of 0.311 mm can be correlated with critically high levels of DDE. These data suggest that of the six eggs collected from these two eyries for captive incubation, none would have hatched in the wilds.

Banding

The U.S. Fish and Wildlife Service, California Department of Fish and Game, and the Peregrine Working Team granted approval to band four-week-old nestlings at six nest sites within the Ukiah BLM District boundary. This is the first time in California that approval has been granted to band wild nesting peregrines since their endangerment, and this is viewed as a positive step towards learning movement patterns of nesting and wintering falcons. Unfortunately, banding efforts commenced a week too late, and only three of the latest nesting peregrine eyries could be rappelled into for fear of prematurely fledging young. Five nestlings were banded with "lock-in" bands supplied by the U.S. Fish and Wildlife Service (Appendix II). It is recommended that banding efforts in the future commence when nestlings are three weeks of age and desist when nestlings are four and one-half weeks of age.

Prey Utilization

Prey remains were collected at 12 peregrine falcon nesting sites. Twenty-five prey species were identified from prey remains gathered in and around the eyries (Table 2). Mourning doves (*Zenaidura macroura*) and starlings (*Sturnus vulgaris*) were identified as the most universal prey species utilized; however, rock doves (*Columbia livia*) were observed comprising the greatest biomass and were considered the most important prey species utilized.

TABLE 2. PEREGRINE FALCON PREY REMAINS COLLECTED AT 12 NEST SITES

Species Common Name	NI 1	NI 2	NI 3	NI 4	NI 6	NI 8	NI 10	NI 13	NI 15	NI 16	NI 17	NI 22	% Total Prey Spp.
Wood Duck					1								1.0
Killdeer						2		1		1			4.2
Ruddy Turnstone										1			1.0
Least Sandpiper						1							1.0
Bonaparte's Gull		1											1.0
Band-tailed Pigeon		1						2		1	1	1	6.3
Rock Dove	1	2			1	1	1			2	7		15.6
Mourning Dove	1	1		1		1		1		1	1	2	9.4
Black Swift												1	1.0
Common Flicker								2			1	1	4.5
Acorn Woodpecker					2				2		3		7.3
Pileated Woodpecker											1		1.0
Stellers Jay		1			2								3.1
Scrub Jay											2		2.1
Belted Kingfisher												1	1.0
Common Crow						1							1.0
Robin			1		1					3	1		6.3
Varied Thrush		1								1			2.1
Western Bluebird								1		1			2.1
Cedar Waxwing									1				1.0
Starling		1		1	1	1		1	4	1	5		15.6
Western Meadowlark						1							1.0
Red-winged Blackbird						1	1				1		3.1
Brewer's Blackbird						2			2	1	3		8.3
Brown-headed Cowbird						1							1.0

DISCUSSION

Helicopter Effectiveness

Use of the helicopter has become a standard survey technique for locating raptor nests. Yet, the overall effectiveness of the helicopter as a survey tool is often questioned. This year (1980), 20 active peregrine falcon eyries were observed by helicopter (19 sites) within the Ukiah BLM District. It was found that data gathered from the helicopter could be cross-referenced to data gathered from the ground, increasing the overall effectiveness of this survey. Three factors studied with great interest were: (1) eyrie visibility (is it possible to fly past an eyrie without seeing it?), (2) does the timing of the survey in relation to the phase of the nesting cycle affect the outcome? and (3) is productivity data gathered from a helicopter accurate? It was assumed that helicopter observers were "trained observers" and knowledgeable of peregrine behavior.

To identify any differences in falcon visibility between the different phases of the nesting cycle, 61.5 hours were spent on the ground observing two active eyries. Conclusions drawn from the ground data, based on visibility, were that surveys could effectively be flown immediately prior to egg laying, during the nestling phase, and during the fledging phase of the nest cycle. During these three phases of the nest cycle, the adult falcon "visibility factor" was 79 to 100 percent (Table 3). However, other ground observations concerned with the nest site defense and aggression eliminate the "prior to egg laying" and the "fledging" phases as effective periods for helicopter surveys. Ground observations during the past two years indicate that prior to egg

TABLE 3.

CHRONOLOGICAL VISIBILITY FACTORS

<i>Nesting Phenology</i>	<i>Hours Observing Eyre</i>	<i>% of Total Observation Hours</i>	<i>Total Hours Peregrines Visible</i>	<i>% of Total Hours Peregrines Visible</i>
Late Courtship	25.3	45	20.1	79
Incubation	22.0	27	11.8	54
Nestlings	6.4	14	6.4	100
Fledgings	6.5	14	6.0	92
Cumulative	60.2	100	44.3	74

laying, parental defensiveness in response to interspecific intrusion at the nest site is absent or, at most, moderate (most cases). After eggs have been laid and until three or four days after fledging, nest site defensiveness is moderate to extreme. Approximately 10 days after young fledge, parental defensiveness becomes only moderate, or less, to man.

In the last two years, 12 of 13 unknown peregrine falcon eyries were located from the helicopter by observing the adult falcon(s) flush from the eyrie cliff. Occasionally when the helicopter approached a nesting cliff, an adult falcon could be observed flushing and disappearing while the helicopter was still over 300 yards away. Other times the falcon(s) would not flush from the cliff until the helicopter passed within 40 yards of the falcon(s). In almost every case that the falcons flushed while the helicopter was close to the cliff, the falcons (one or both) would flush, circle, and disappear. Then, as the helicopter pulled away, the falcon(s) would reappear and return to the nest ledge. The unwillingness of the adult falcons (one or both) to vacate the nesting vicinity upon approach by the helicopter is probably a defensive reaction.

It is reasoned that the falcons exhibiting defensive behavior are much more visible. Based on defensiveness then, the pre-egg phase and the post-fledging phase of the nest cycle are not effective periods for helicopter surveys. Furthermore, helicopter surveys have revealed that after the young have fledged, they will often freeze on the nesting cliff upon approach of the helicopter and are difficult to see. The adults also tend to be inconspicuous

at this time. Surveys flown after the fledging of young can easily miss nesting sites, especially when nest ledges are concealed. It is highly probable that helicopter surveys searching for unknown peregrine falcon nesting habitats will meet with much greater success if flights can be scheduled during the nestling phase of the nest cycle. This has been found to be the most effective time for a nesting survey, yet this alone will not guarantee that nesting sites will not be missed.

Helicopter surveys in 1980 were scheduled during the nestling phase of the nest cycle. Forty percent of the 20 eyries observed from the helicopter were without visible adult falcons. Considering only nests that successfully fledged young (n=14), 29 percent were without defending (or visible) adults while the helicopter was present (NI 2, 8, 14, 19). If these eyries were not previously known, they would never have been observed from the helicopter. These data may have been influenced by unseasonable weather conditions present this year (high winds).

The above paragraphs suggest that helicopter surveys in search of peregrine falcon nesting sites may not be the perfect tool; however, helicopters are the best tool available and can only be improved upon with the addition of simultaneous ground surveys.

A final question answered this year about helicopter effectiveness concerns productivity. Often during helicopter surveys, only a single defending adult is observed at a cliff site. No nest or second falcon is observed. Are these "bachelor sites" (a site maintained by only one adult falcon), or

are the chances good there is a hidden eyrie in the vicinity? Observations from the helicopter at 18 sites that were later ground-truthed for productivity data showed: at five sites, both adults were present (28 percent) (NI 6, 11, 15, 16, and the Redding District eyrie); at five sites, one adult was present (28 percent) (NI 3, 7, 10, 17, and 22); and at eight sites, no adults were present (44 percent) (NI 1, 2, 5, 8, 13, 14, 19, 20). At sites observed with both adults present, 80 percent fledged young (NI 15 is counted as failing); at sites with one adult present, 80 percent fledged young; and at sites with no adults present (as viewed from the helicopter), 50 percent fledged young.

These data strongly indicate that cliffs observed from the helicopter with at least one defending adult peregrine falcon (a falcon present and reluctant to vacate), but without a visible eyrie, will probably fledge young. Based on this assumption and observed parental defensiveness, sites NI 18 and 21 probably fledged young (these two sites were not ground-truthed). Occupied cliff sites where adult falcons are observed from the helicopter, but where an actual nest is not observed, cannot be used in productivity statistics, even though it is more correct to assume these sites are active and probably successful, rather than only being maintained by a single falcon. Ground observers should be sent into these sites to verify the outcome whenever possible.

Nesting Densities and Population Stability

California contains the largest nesting population of the American peregrine falcon in the continental United States. In the past three years it has become apparent that Northern California is exceedingly important to the remnant population of the American peregrine falcon. This geographic region contains

a major proportion of California's peregrine falcon nesting population.

The affinity that peregrines have for Northern California and the fact they have not been extirpated from this region can be explained by isolation, amiable nesting elevations (Table 4), a seemingly abundant prey base, and lower pesticide loads compared to southern portions of the State (Monk et al. 1980). Presently, there are three major nesting concentration areas and many smaller concentration areas in Northern California. These habitats occur within areas under management by the BLM and U.S. Forest Service.

TABLE 4. ELEVATIONS OF ACTIVE PEREGRINE FALCON EYRIES

<u>Elevation above Sea Level</u>	<u>0-500</u>	<u>1000-2000</u>	<u>2000-3000</u>	<u>3000-4000</u>
Number of Eyries	0	9	10	2

Nesting density data obtained in this inventory are difficult to compare with data from previous studies. Some researchers give numbers of nesting birds per linear kilometer, and others give numbers of nesting birds per square kilometer. It would seem the number of pairs per square kilometer is the best estimate of a true density calculation, but this calls for a subjective estimate of the nesting territory size. Ratcliffe (1962) used an area measurement of density by assuming that the breeding territory is the area defined by hypothetical boundaries lying midway between a nesting pair and its various neighbors.

Other researchers have attempted to describe nesting densities using a linear description. Hickey (1942) mentions that two nesting pairs were only half a mile (.63 km) apart, and that a seven-mile (11.2 km) range of cliffs held five pairs. Beebe (1960) found up to eight pairs of nesting peregrines (*F. p. pealei*) in a linear mile (1.6 km). Both density estimates were concerned with the highest densities observed within a widespread population. The linear description was found most practical for this study, but it is not meant to suggest that nests occurred in a straight line. Linear density in this study represents average distances between active nests.

This year, nesting densities in the Ukiah BLM District were observed in greater densities than last year (Monk 1979). This phenomenon probably does not represent a recovering population, only the efforts of an intensified helicopter survey. One area that had the highest nesting density observed in this study may represent an interrelated "family," or a subpopulation of the Northern California population. This region contains five nesting pairs of peregrine falcons with an average linear distance of 5.8 miles (9.28 km) between nests. The average distance between the closest four sites was only 4.7 miles (7.52 km). The distance extremes between the five nesting sites ranged from 4.2 miles (6.72 km) to 9.1 miles (14.56 km).

Another subpopulation (probable "family" group) within the Ukiah BLM District was also observed nesting in extraordinary concentrations. This population consisted of four nesting pairs with an average distance of six miles (9.6 km) between sites and a minimum distance between two sites of five miles (8 km). This subpopulation of nesting peregrines is separated from the previously mentioned subpopulation by several coastal ridges and about 50 linear miles (80 km).

Almost certainly, the inland peregrine nesting population in California has experienced the declines other peregrine falcon nesting populations have in North America (Hickey 1969), particularly in Southern California (Herman et al. 1970). In northwestern California, population declines do not appear nearly so severe as the southern and coastal populations and may reflect a "cleaner" prey base (less contaminated by organochlorine pollutants such as DDT).

Nevertheless, an unaided fledging success of 1.35 young per nest attempt is far below the *Pacific Coast Recovery Plan* objectives of 1.75 young fledged per nest attempt (U.S. Fish and Wildlife Service 1980). Furthermore, the level of productivity is below theoretical population models, which hypothesize that 2.5 nesting peregrines must fledge per nest attempt to maintain a "stable population" (Young 1969). Other researchers have based stability estimates upon field observations and have concluded that a minimum of 1.5 fledged young per nest attempt is necessary to maintain a stable population (Hickey 1942, Cade 1960, Porter and White 1973). Based on these data, it is apparent that the northwestern California peregrine falcon population is unstable.

Many sites fledged healthy clutches of young this year; the majority of eyries fledging young fledged one to three nestlings (Table 5). According to the *Pacific Coast Recover Plan*, two to three young fledged per successful nest is "normal" (U.S. Fish and Wildlife Service 1980). However, it is the author's judgement that an average of 2.08 young fledged per successful nest, in addition to at least a 32 percent failure rate, indicates that the overall population is not healthy or "normal" and rightfully should be considered an endangered population.

TABLE 5.PEREGRINE FALCON BROOD SIZES

<u>Number of Nestlings</u>	<u>Number of Repre- sentative Eyries</u>	<u>Percent Of Total Eyries</u>
1	5	36
2	3	21
3	5	36
4	1	7

Protection and Management

The U.S. Government manages lands that are very important to the survival of the peregrine falcon in northwestern California. It is the responsibility of government agencies to safeguard and manage peregrine falcon nesting territories by providing information on the "critical habitats" of these birds in the planning system process. When conflicts of interest arise, upper level management personnel (including biologists) at the District and State Office should work out a "best course of action." Conflicts should not become issues to the general public or private companies that are concerned with development. If the planning system is working properly, private companies will never be allowed to create conflicts.

The District Office should be responsible for notifying the Endangered Species Coordinator at the State Office (presently Dr. Richard Olendorff) of all impending impacts within three miles of a nesting site. At this time,

a specialist can assess actual impacts to the nesting site. This procedure may allow activities to proceed that would otherwise be blocked by a non-specialist's biological opinion. There are many variable factors involved with disturbance to an eyrie (e.g., elevation of proposed disturbance in relation to the eyrie, line-of-sight impact vs. short-term impact, etc.). A biologist unfamiliar with peregrine biology would have a difficult time assessing these factors. Since peregrine biologists cannot be expected to be on hand, a baseline planning format follows. It should not be deviated from without consultation with the U.S. Fish and Wildlife Service.

"Short-term impacts" are those impacts that will not result in major permanent habitat alterations and/or bring a permanent flow of human activity into an area. These impacts usually occur in local areas and have a disturbance duration of less than four months. These impacts include "test drill-pad sites," fencing projects, timber harvesting, etc.

Short-term impacts are the most common type of conflict facing peregrine falcons in northwestern California today. If nesting peregrines are granted considerations, these impacts constitute no measurable threat to the continuation of a nest site. The considerations that must be adhered to follow. No exploitation activities should be allowed within two miles (3.2 km) of an eyrie from February 15th through July 20th without evaluation by a specialist. Even then, no exploitation should be allowed within a mile (1.6 km) of an active eyrie between these dates. Also, non-biologist groups of people approaching

the nest site on foot should be restricted to safe periods of the nesting cycle, or to periods occurring ten days after eggs hatch (approximately May 25th) to ten days prior to fledging (approximately June 20th). These dates vary from year-to-year and between nest sites and are best obtained each year from the Endangered Species Coordinator in the State Office. Visits to active nest sites should be restricted to as few as possible and should be nondisruptive in nature. All biologists approaching an active site should not approach closer than one-third mile (.57 km) without State Office and Fish and Wildlife Service approval.

"Long-term" impacts are those impacts where permanent structures or alterations occur that will remain at the impact site for an indefinite period of time. These impacts must not be allowed to occur within two miles of an active peregrine eyrie. Examples of long-term impacts include surface mining, steam well development, construction projects like road development, and housing. Permanent habitat alterations are one of the greatest threats to peregrine falcons in California today. In most cases, when a geographic area is developed, the area loses its value as nesting habitat forever. Long-term impacts occurring in hunting territories must also be considered.

For some prey remains collected this year, the nearest location they could have been captured was 20 miles (32 km) from the nest site. Porter and White (1973) followed a foraging peregrine falcon by helicopter for a distance of 17 miles (27.2 km) from a nesting cliff. These examples point out that a great many square miles are utilized by foraging peregrines. Long-term impacts

occurring within these hunting territories are numerous and exceedingly difficult, if not impossible, to measure. The adverse effects of developments in hunting territories will logically result in lower prey availability. Presently, this does not appear to be a problem in northwestern California. However, any disturbance or development occurring in hunting territories must be monitored each year, before they seriously threaten the existence of nesting peregrine falcons. In future years, as hunting territories are developed, alternate food sources must be considered to guarantee the survival of the northwestern California nesting population as it exists today. Garrett (1978) has suggested installation of pigeon lofts adjacent to active eyries to avert food shortages as they occur in developed areas.

Nest site protection is a more tangible management procedure and should be actively pursued. Since it is difficult and costly to assess impacts to hunting territories, we must concentrate on nest site protection and hope to identify critical hunting territories in the future.

Future Expectations

The Ukiah BLM District has now been surveyed almost entirely by helicopter. These surveys have covered all but about 15 percent of the BLM lands and about 35 percent of private lands adjacent to BLM and U.S. Forest Service lands. The highest quality nesting habitats have been surveyed on BLM lands. However, peregrine falcon eyries have been found on smaller cliffs, and many areas only briefly looked at should be reevaluated. Three of the six new peregrine falcon eyries located this year were on seemingly mediocre cliffs (small). It is

probable that several additional eyries occur in unsurveyed habitats (Table 6).

TABLE 6. AREAS TO BE SURVEYED IN THE FUTURE

<u>Quad Name</u>	<u>Area</u>	<u>Priority</u>
Navarro	Cliff Ridge	1
Pilot Creek	Windy Ridge	2
Coyote Peak	Coyote Rock	3
Potter Valley	Lander Flats and n.e.	4
Lakeport	Pinnacle Rock	5
Lakeport	Alder Spring Ridge	6

Perhaps of greater importance is the expected outcome of next year's manipulation program. Now that 12 previously unknown peregrine falcon eyries have been identified in the last two years, it is imperative to actively manage these sites if necessary to ensure productivity. Management experiences this year were invaluable for testing and improving previously developed techniques and for developing new techniques. This year's fledging success of 1.35 young fledged per nest attempt was well below the desired goal of 1.75 young fledged per nest attempt set by the American Peregrine Falcon Recovery Team (1979). In the absence of unforeseen events, such as weather extremes, it is likely that augmentation and other management techniques can greatly enhance next year's observed fledging success.

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RECOMMENDATIONS

1. Provide additional consultant fees in future years to assist the multiple phases of the project.
2. Increase helicopter time next year for active management purposes.
3. Conduct a study next year to survey all remaining areas identified in this report as having potential for nesting peregrines.

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APPENDIX I

1980 PEREGRINE FALCON NESTING CHRONOLOGIES

<u>Nest Site</u>	<u>First Day of Incubation</u>	<u>Hatching Date</u>	<u>Date Fledged</u>	<u>No. Fledged</u>
NI 1	*F	F	F	0
NI 2	1 April	1 May	10 June	2
NI 3	14 April	F	F	0
NI 4	F	F	F	0
NI 5	F	F	F	0
NI 6	2 April	2 May	13 June	4
NI 7	30 March	1 May	10 June ?	2
NI 8	30 March	29 April	14 June	2
NI 9	30 March	29 April	10 June	3
NI 10	19 April	20 May	27 June	3
NI 11	31 March	2 May	14 June	1
NI 12	30 March	29 April	10 June	3
NI 13	14 April	F	F	0
NI 14	?	?	15 June	3
**NI 15	14 April	15 May	22 June	1
NI 16	?	?	12 June	1
NI 17	30 March	29 April	12 June	1
NI 18	?	?	?	?
NI 19	2 April	3 May	9 June	1
NI 20	F	F	F	0
NI 21	?	?	?	?
NI 22	31 March	1 May	13 June	1

*F - Failure to fledge young

** - This site augmented and counted as fledging 0 in statistics

APPENDIX II

BANDED YOUNG AT PEREGRINE FALCON EYRIES

<u>Nest Site</u>	<u>No. of Young Banded</u>	<u>Sex</u>	<u>Banded Identification No.</u>
NI 8	1	F	987-07307
NI 10	3	F	987-07308
		?	987-07309
		?	987-07310
NI 15	1	M	816-15577

BORROWER'S CARD

96 .F34 M74 1980

grine falcon inventory

BORROWER	OFFICE	DATE RETURNED
PS Library	ILL	4/2/91

(Continued on reverse)

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